TR114™ PCI Digital Hardware Guide

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Preface

About this Manual

This manual describes how to configure, install, and test the Brooktrout PCI digital boards.

This manual is divided as follows:

Chapter 1 - Presents information on the basic features of the TR114 PCI digital boards and describes the hardware, operating, and environmental requirements of the TR114 PCI digital boards.

Chapter 2 - Explains how to configure and install the TR114 PCI digital boards and connect the SCbus or MVIP bus to the board.

Chapter 3 - Explains how to connect a TR114+P8V-T1 board to the telephone service.

Chapter 4 - Describes how to test and troubleshoot TR114 PCI digital boards as well as the channels that they support.

Chapter 5 - Lists the ways to contact Brooktrout technical support and describes the information that you should furnish when requesting help.

Appendix A - Explains how to interpret the LEDs on the TR114 boards.

Appendix B - Provides information on North American regulations with which the PCI digital boards comply.

Appendix C - Describes the *digital.cfg* file as well as using DNIS and dialing prefixes.

Appendix D - Explains how to configure the TR114+P8V-T1 when there is more than one NIC on an MVIP bus.

Related Documents

TR114 Firmware Installation and Release Notes
Fax, Voice, and Data API V4.0 Volume 1 User's Guide
Fax, Voice, and Data API V4.0 Volume 2 Programmer's Reference
TR114 ISA Digital Hardware Guide

If you are a LANfax user, the fax application may come with its own documentation and not all of the above manuals would be applicable.

Manual Conventions

This manual uses the following conventions:

- *Italics* denote file names, directory names, and program names within the general text.
- The **`Courier`** font in bold indicates a command sequence entered by the user at the system prompt, for example:

  ```
  cd /usr/sys/bfax/app.src
  ```

  The Courier font not bolded indicates system output, for example:

  ```
  c:>Files installed.
  ```

- The icon indicates a **Caution** because damage to software or hardware can occur if proper precautions are not observed.
- When used by itself, the term 'TR114' refers to any of the TR114 PCI digital boards.

Chapter 1
Introduction

The TR114™ PCI digital boards are for use in computers with PCI buses. The TR114 is suitable for fax broadcast, fax-on-demand, fax store and forward, LAN fax servers, email to fax services, and combined voice and fax applications.

Configurations

The TR114 PCI digital board is available in the following configurations:

TR114+P2V	Two channels with an MVIP interface.
TR114+P8S	Eight channels with an SCbus interface.
TR114+P8V	Eight channels with an MVIP interface.
TR114+P8V-T1	Eight channels with an MVIP and an integrated T1 interface.
TR114+P16S	Sixteen channels with an SCbus interface.
TR114+P16V	Sixteen channels with an MVIP interface.

Features

The TR114 PCI digital board has the following features:

- Up to 16 independent fax and voice channels in one PCI bus slot.
- Each channel has a 25 MHz microprocessor (32-bit CISC with built-in DSP) and 2MB RAM with parity checking.
- Full Group 3 fax send and receive functionality on each channel, with advanced features, such as Error Correction Mode and MR or MMR compression.

- Speech record and playback.

  Each channel can record and play back ADPCM and μ-law PCM, permitting developers to build a variety of fax and voice systems—voice-prompted fax retrieval systems, fax mail systems with voice annotation capability, integrated voice/fax mail systems — all using a single TR114.

- Downloadable firmware.

  You can easily install updates, even in the field, from a floppy diskette to add enhanced system functionality without replacing hardware.

- DTMF (Touch-Tone), SIT, CNG, and CED detection capability.
- Group 3 and 4 fax compression. Auto conversion of ASCII, MH, MR, MMR, TIFF, and PCX/DCX files and binary file transfer.
- Automatic reduction or expansion of the page width on transmission.
- Adaptive call progress detection capability that works world-wide.
- Links to the telephone network and other CTI boards via the SCbus or MVIP bus.
- Integrated T1 interface for the TR114+P8V-T1
- API tools and software drivers to work with many operating systems. Contact Brooktrout technical support for the latest information on supported operating systems.

Computer Platforms

Brooktrout recommends the following PC manufacturers:

Diversified Technology, Inc. 800-443-2667
Industrial Computer Source 800-523-2320
Compaq Proliant servers: 1600, 2500, 5500, 7000
www.compaq.com

Hardware Requirements

Each TR114 board requires:

- One 32-bit slot in any computer with a PCI bus.
- Telephone service via SCbus or the MVIP bus.
- A digital telephony interface card to connect each board (except the TR114+P8V-T1) to the T1/E1 telephone service. The TR114+P8V-T1 has its own integrated T1 interface card.

  You can use the Brooktrout TRNIC Series™ board (for the MVIP boards) or any other T1 network interface card that supports SCbus and MVIP.

Operating and Environmental Requirements

Power requirements for the TR114 series boards are:

Type	5V DC	-12V DC	Power
TR114+P2V	750 mA	26 mA	4 W
TR114+P8S	1.9 A	104 mA	10.7 W
TR114+P8V	1.26 A	104 mA	7.5 W
TR114+P8V-T1	1.4 A	104 mA	8.3 W
TR114+P16V	4.0 A	208 mA	22.5 W
TR114+P16S	3.8 A	208 mA	21.5 W

- Temperature: 0°C – 50°C (32°F – 122°F)
- Humidity: 10% – 95% (noncondensing)
- Cooling: Direct forced-air flow over each board. We recommend a supplemental fan blowing directly across the board for 8- and 16-channel boards.

Chapter 2
Configuration and Installation

This chapter shows the layout of the boards and explains how to perform the following operations:

- Set MVIP or PEB termination. The SCbus in SCSA mode does not require termination.
- Set the T1 options (SW2) and MVIP options (SW3) on the TR114+P8V-T1 daughter board.
- Set the board ID for SCbus boards (optional).
- Install the TR114 in a system.
- Install the TR114's firmware.

Board Layout

Figure 2-1 shows the layout of the TR114+P2V, TR114+P8V, and TR114+P16V boards.

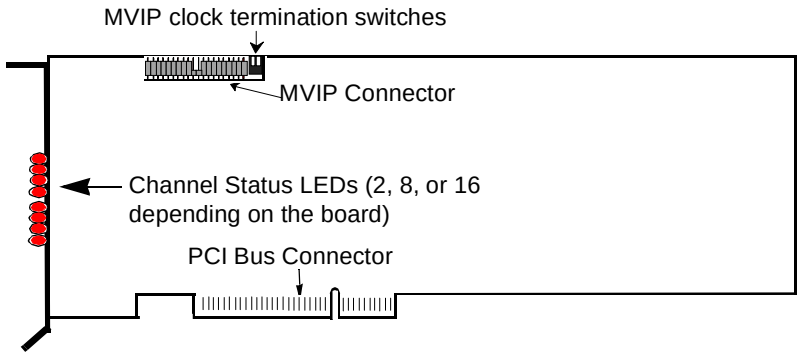

Figure 2-1. TR114+P2V, TR114+P8V, and +P16V Board Layout

Figure 2-2 shows the layout of the TR114+P8S and TR114+P16S boards.

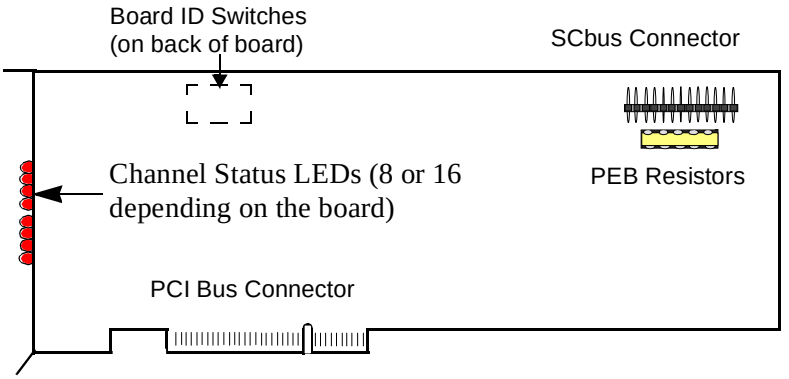
Board ID Switches
(on back of board)
SCbus Connector
Channel Status LEDs (8 or 16 depending on the board)
PEB Resistors
PCI Bus Connector

Figure 2-2. TR114+P8S and TR114+P16S Board Layout

The TR114+P8V-T1 consists of a T1 network interface card mounted on a TR114+P8V board. Figure 2-3 shows the layout of the TR114+P8V-T1. The positions of some components on the T1 card are indicated by dotted lines.

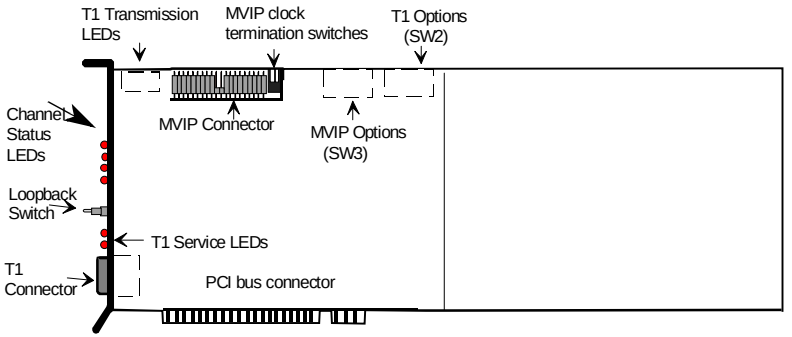

Figure 2-3. TR114+P8V-T1 Board Layout

Default Configuration Settings

These PCI boards do not require switch or jumper setting for I/O address or IRQ because the PC BIOS automatically assigns addresses and an IRQ to each board. You can quickly set up and install a TR114 PCI board by accepting the following factory-assigned settings:

MVIP Board Defaults

- MVIP termination: **ON (terminated)**
- Options for P8V-T1
  - T1 options:

T1 clock master	**T1 line provides the clock master**
Framing	**Superframe (SF)**
Line coding	**B8ZS**
T1 cable length	**0 to 132 ft.**

  - MVIP Options:

MVIP stream pair	**6/7**
MVIP clock master	**TR114+P8V-T1**
MVIP sync ctrl	**TR114+P8V-T1**
MVIP termination	**Unterminated**

SCbus Board Defaults

- Board ID **0**
- SCbus Termination

SCSA mode	**No termination required**
PEB mode	**Resistors installed (terminated)**

Changing the Default Settings

In some cases, you will not be able to use all the factory-assigned settings and will have to change one or more configuration options. The following sections describe how to change the settings.

Setting MVIP Clock Termination

The clock on the MVIP bus requires termination. A two position DIP switch controls termination for the MVIP clock signals on all the TR114 boards. It is located on the board's top edge, next to the MVIP connector. See Figures 2-1 and 2-3 for the location of the MVIP connector on your TR114 board. Set both switches to ON for termination as shown in Figure 2-4.

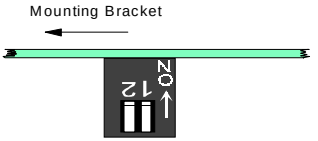

Figure 2-4. MVIP Clock Termination Switches

MVIP clock termination requirements depend on the number of connections on the MVIP bus. Follow these guidelines:

- Install the telephony network interface card (or the TR114+P8V-T1) at one end of the cable.
- For systems with 5 or fewer MVIP bus connections, terminate the MVIP resource board (such as a TR114) at the end of the cable opposite the NIC. Make all other boards on the cable unterminated.
- For systems with more than 5 MVIP bus connections, terminate both ends of the MVIP cable – the NIC and the MVIP resource board at the opposite end of the cable. Make all other boards on the cable unterminated.

Switches 5 and 6 of SW3 on the TR114+P8V-T1 daughter board control termination for the daughter board. See Figure 2-3 for the location of SW3 and Figure 2-6 for a detailed illustration of SW3.

When setting MVIP clock termination on the TR114+P8V-T1, treat the base board of the P8V-T1 as a separate board. If you are installing the TR114+P8V-T1 by itself, terminate just the MVIP clock on the base board. Otherwise follow the guidelines above.

Setting T1 Options on the TR114+P8V-T1

Use the switches of SW2 to set the T1 options. See Figure 2-3 for the location of SW2 on the TR114+P8V-T1. Switches 7 and 8 of SW2 are nonoperational and do not affect TR114+P8V-T1 operation. Figure 2-5 shows SW2 with the switches set to the default.

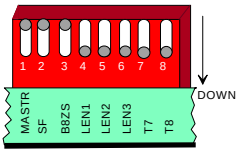

Figure 2-5. T1 Switches (SW2)

To configure the T1 clock master, framing mode, and line coding options for the TR114+P8V-T1, set the switches as shown in Table 2-1. DOWN means towards the board and UP means away from the board. Default settings are shown in **bold**.

Table 2-1. Valid T1 Options

Switch	Meaning	Setting	Mode
1	T1 clock master (MASTR)	**UP** DOWN	**Network** TR114+P8V-T1
2	Framing mode (SF)	**UP** DOWN	**SF** ESF
3	Line coding (B8ZS)	**UP** DOWN	**B8ZS** AMI

The modes are:

- ***T1 clock master***

  T1 (network) – T1 generates and transmits the clocking signals to the TR114+P8V-T1.

  TR114+P8V-T1 – The TR114+P8V-T1 generates and transmits the clocking signals to the T1.

- ***Framing mode***

  SF (Super Frame**) –** A transmission structure that divides the data into twelve, 193-bit blocks or frames.

  ESF (Extended Super Frame) **–** A transmission structure that divides the data into twenty-four, 8,000 bps blocks or frames.

- ***Line coding***

  B8ZS (Binary 8 Zero Substitution**) –** A T1 line-coding format that inserts two violations of the bipolar line encoding technique instead of inserting a 1 for every seven consecutive 0s.

  AMI (Alternate Mark Inversion) – A T1 line coding format that represents binary 1s (marks) as signals of equal amplitude, but that alternately inverts the polarity of each successive mark. It represents binary 0s as signals of zero amplitude.

Setting the T1 Cable Length

Switches 4, 5, and 6 of SW2 set the length of the cable that connects the TR114+P8V-T1 to the T1 network. The default setting is 0 to 132 feet. If the length of your network cable exceeds 132 feet, change the default setting to the setting that most closely corresponds to the actual length of your cable.

Examine the installation environment and set the length as accurately as possible. An incorrect setting for the cable length affects signal quality and can adversely affect operation of the TR114+P8V-T1.

To configure the length of the network cable, set the switches as shown in Table 2-2. The default settings of switches 4, 5, and 6 are shaded.

Table 2-2. Valid Cable Length Settings

Cable length	4 (LEN1)	5 (LEN2)	6 (LEN3)
0 to 132 ft.	DOWN	DOWN	DOWN
133 to 266 ft.	UP	DOWN	DOWN
267 to 398 ft.	DOWN	UP	DOWN
399 to 532 ft.	UP	UP	DOWN
533 to 654 ft.	DOWN	DOWN	UP

You can change these switches while the TR114+P8V-T1 is powered on without causing the board or the system to malfunction. The TR114+P8V-T1 monitors these switches once every second and when it detects a change, it reconfigures its operation.

Setting MVIP Options on the TR114+P8V-T1

Use the switches of SW3 to set the MVIP options. See Figure 2-3 for the location of SW3 on the TR114+P8V-T1. Switches 7 and 8 of SW3 are nonoperational and do not affect TR114+P8V-T1 operation. Figure 2-6 shows SW3. In the figure, the switches are set to the default.

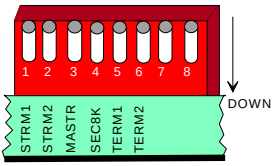

Figure 2-6. MVIP Options Switches (SW3)

To configure the MVIP options, set switches 1 through 6 as shown in Table 2-3. Note that the default switch setting of the switches and the modes that they select are in **bold**.

Note: Down means toward the T1 daughter board and UP means away from the T1 daughter board.

Table 2-3. Valid MVIP Options set with SW3

Switch	Meaning	Setting	Mode
1, 2	MVIP Stream Select (STRM1, STRM2)	**UP, UP** DOWN, UP UP, DOWN DOWN, DOWN	**6/7** 4/5 2/3 0/1
3	MVIP Clock master (MASTR)	**UP** DOWN	**TR114+P8V-T1 master** TR114+P8V-T1 slave
4	Clock sync functions:	Functioning depends on mode set for MVIP master clock (switch 3)	
4 *w/3 UP*	Sync source ctrl (SEC8K)	**UP** DOWN	**TR114+P8V-T1** Secondary net card
4 *w/3 DOWN*	Framing sig. output (SEC8K)	**UP** DOWN	**Disable output** Enable output
5, 6	Termination (TERM1, TERM2)	**UP, UP** DOWN, DOWN	**Unterminated** Terminated

The modes are:

- ***MVIP Stream Select (STRM1, STRM2)***

  Selects the MVIP data/signaling pair: 0/1, 2/3, 4/5, or 6/7. By convention, even numbered streams carry data, and odd numbered streams carry signaling.

- ***MVIP Clock Master (MASTR)***

  Leave at the default setting if you have one NIC on the MVIP bus. See *Appendix D, Using Two or More NICs on the MVIP Bus* for information on setting this switch when you have more than one NIC on the MVIP bus.

- ***MVIP Clock Synchronization Functions (SEC8K)***

  Leave at the default setting if you have one NIC on the MVIP bus. See *Appendix D, Using Two or More NICs on the MVIP Bus* for information on setting this switch when you have more than one NIC on the MVIP bus.

- ***MVIP Termination (TERM1, TERM2)***

  Enables or disables MVIP clock termination. For details, see *Setting MVIP Clock Termination* on page 2-4.

Be sure that the MVIP parameters in the *digital.cfg* file match those actually used on the TR114+I8V-T1 and its associated resource boards.

LAN fax users: Typically, for software setup, you set parameters in the *digital.cfg* file or through a board setup procedure. See the documentation supplied with your software.

Setting the Board ID (SCBus Boards Only)

If your system has multiple TR114 PCI boards, it may not be apparent which board contains which channel numbers. The board ID switches on the back of the board (see Figure 2-2 for their location) can be used to uniquely identify the board using a hexadecimal number from 00 through 1F. By identifying each board, you can determine the channels that belong to that board using the MS-DOS driver or the *faxinit* program. See the Brooktrout Application Programming Interface User's Guide for more information. Use of the board ID is optional. You can leave the board ID set to 0 on all TR114 PCI SCbus

boards; the driver will operate normally no matter what value the board ID is set to.

Figure 2-7 shows the board ID switches set to 08.

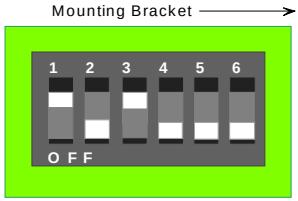

Figure 2-7. Board ID Switches

Use switches 2 through 6 to set the board ID. Switch 1 (on the left) is not operational. Table 2-4 shows the values that correspond to the settings.

Table 2-4. Board ID Settings

ID	Switch				
	2	3	4	5	6
00	OFF	OFF	OFF	OFF	OFF
01	OFF	OFF	OFF	OFF	ON
02	OFF	OFF	OFF	ON	OFF
03	OFF	OFF	OFF	ON	ON
04	OFF	OFF	ON	OFF	OFF
05	OFF	OFF	ON	OFF	ON
06	OFF	OFF	ON	ON	OFF
07	OFF	OFF	ON	ON	ON
08	OFF	ON	OFF	OFF	OFF
09	OFF	ON	OFF	OFF	ON
0A	OFF	ON	OFF	ON	OFF
0B	OFF	ON	OFF	ON	ON
0C	OFF	ON	ON	OFF	OFF
0D	OFF	ON	ON	OFF	ON
0E	OFF	ON	ON	ON	OFF

Table 2-4. Board ID Settings

ID	Switch				
	2	3	4	5	6
0F	OFF	ON	ON	ON	ON
10	ON	OFF	OFF	OFF	OFF
11	ON	OFF	OFF	OFF	ON
12	ON	OFF	OFF	ON	OFF
13	ON	OFF	OFF	ON	ON
14	ON	OFF	ON	OFF	OFF
15	ON	OFF	ON	OFF	ON
16	ON	OFF	ON	ON	OFF
17	ON	OFF	ON	ON	ON
18	ON	ON	OFF	OFF	OFF
19	ON	ON	OFF	OFF	ON
1A	ON	ON	OFF	ON	OFF
1B	ON	ON	OFF	ON	ON
1C	ON	ON	ON	OFF	OFF
1D	ON	ON	ON	OFF	ON
1E	ON	ON	ON	ON	OFF
1F	ON	ON	ON	ON	ON

Setting Termination for the SCbus

The SCbus can operate in one of two modes:

- SCSA mode

  The SCbus in SCSA mode does not require termination. If the PEB resistor bank is present on the board, remove it.

- PEB mode

  The SCbus in PEB mode requires termination. The PEB termination resistor bank, located directly below the SCbus connector (see Figure 2-2), controls termination for the PEB implementation of the SCbus board.

Install the resistor bank on only the TR114 board attached to the last connector at the opposite end of the cable from the network interface card. Remove the resistor bank from all other TR114 boards in the system.The resistor bank is shown in Figure 2-8.

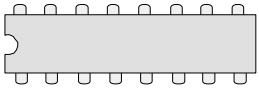

Figure 2-8. PEB Bus Resistor Bank

Installing the TR114 Board

After configuring the board, you are ready to install the TR114 board in your computer. We recommend you keep a record of the T1 and MVIP options for the TR114+P8V-T1. You will need these values later when you configure your software. To install the board:

1. Power off the computer.
2. Remove the computer's cover. If the system has a board hold-down bar, remove it as well.
3. Locate an unused PCI slot and remove the bracket for it.
4. Holding the TR114 at each top corner, insert the board firmly into the PCI slot.
5. Screw the TR114's mounting bracket securely to the computer's frame.
6. Connect the PCM cable. See *Attaching the PCM Bus to the TR114*.
7. Turn on the computer.

Attaching the PCM Bus to the TR114

The MVIP and SCbus protocols adhere to certain cabling specifications. If you do not follow these cabling specifications when you cable the resource boards – TR114s, network boards, or other boards – to the telephony interface card in your system, your system may fail with a digital configuration error.

The cabling specifications for these protocols, as they are described in this hardware guide, are described in the following sections.

MVIP Cabling Specifications

The MVIP connector (see Figure 2-9) attaches to a 40-pin ribbon cable. See Figures Figure 2-1 and Figure 2-3 for its location on the TR114 boards.

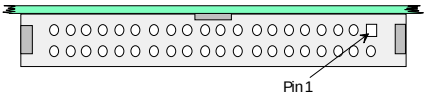

Figure 2-9. MVIP Connector Pin Configuration

Cable length	22" maximum
Number of connectors	22 maximum
Distance between connectors	≅1" (at least the distance between board slots in PCs)
Termination	See *Setting MVIP Clock Termination* on page 2-4.

SCbus Cabling Specifications

The SCbus connector (see Figure 2-10) attaches to a twenty-six pin ribbon cable. See Figure 2-2 for its location on the TR114 boards.

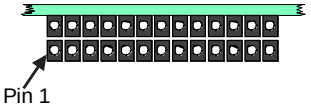

Figure 2-10. Pin Configuration of the SCbus Connector

Cable length	21" maximum
Number of connectors	21 maximum
Distance between connectors	1.0" minimum
Termination	SCbus in SCSA mode requires no termination. See *Setting Termination for the SCbus* on page 2-10 for termination in PEB mode.

To install the telephony interface card and TR114s in your system, follow these instructions:

1. Install the telephony interface card in the first available expansion slot followed by each TR114 board in adjacent expansion slots.
2. According to the protocol's cabling specifications, connect the MVIP/SCbus bus connectors to each TR114 making sure that pin one of the bus connector is connected to pin one of the MVIP/SCbus board connector.

   Pin one of the MVIP/SCbus bus connector is located on the same side of the MVIP/SCbus cable as the colored strip that runs down the length of the cable.

   Figures Figure 2-11 and Figure 2-12 show the MVIP and SCbus multiboard cabling schemes as viewed from the top.

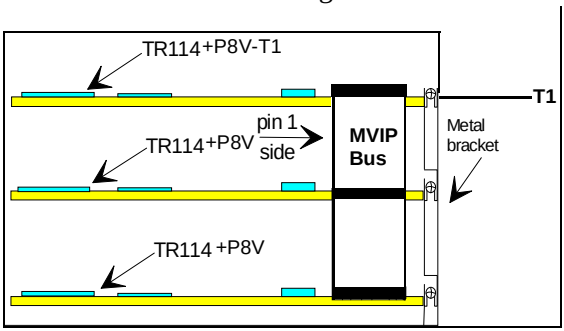

Figure 2-11.Attaching the MVIP Bus

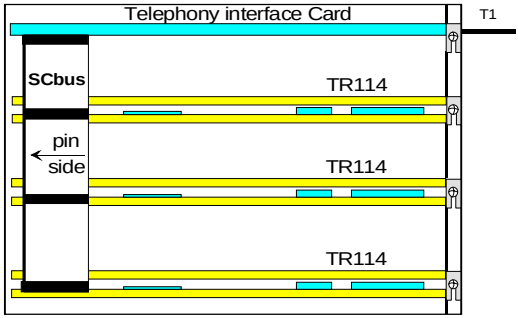

Figure 2-12.Attaching the SCbus

After Installing the Board and Cables

Once you have installed the board and cables, you can test the board by running the *faxtest* program (see *Testing the Board* on page 4-1) and then install software. Or you can install software immediately.

Installing Software

You need to install software to run the boards. If you are an application developer, you would install the Brooktrout-supplied driver, API, and firmware. If you use software from another vendor, see that vendor's manual for instructions on installing software.

Installing the Brooktrout Software

The Brooktrout API and driver are available for a variety of operating systems. See the *Brooktrout Fax, Voice, and Data API User's Guide* for information on installing the API and driver for a specific operating system.

The TR114 firmware is included on a single DOS-formatted diskette. Before running any applications that use the TR114 board, consult the *TR114 Firmware Installation and Release Notes* for detailed instructions on how to copy the contents of this diskette onto your hard disk. The Brooktrout API/driver downloads the firmware for you.

Installing LAN Fax Software

If you use software from another vendor, in most cases the firmware may already be included with the software, which automatically downloads the firmware to the board.

See your LAN fax application's user manual for instructions on installing your LAN fax software. After you have set up your LAN fax software to support the TR114 board, you can begin sending and receiving faxes.

Using PCI and ISA Boards in the Same System

For PCI boards, the PC BIOS automatically configures the addresses and hardware interrupts (IRQs), which may change when the system is rebooted, especially if devices are added or moved.

If you have a TR114 ISA board in your system when you install a TR114 PCI board, the BIOS will not recognize the ISA board when it configures the PCI board. All TR114 ISA boards share one unique IRQ. An IRQ can be shared among PCI boards, but not between PCI boards and ISA boards. The Brooktrout drivers will not load if such a conflict exists.

If you select an IRQ when installing the Brooktrout driver, the driver will reserve that IRQ, but will not use it for the PCI board. If you select a DMA channel (which is not used by PCI boards), the driver will reserve that channel, but will not use it for the PCI board. Thus, you will be wasting the IRQ or DMA channel and could cause a conflict with another board or device.

If there are conflicts between your TR114 PCI and ISA boards' resources, you may need to make changes to the computer BIOS or setup. The method you use depends on your brand of computer. Check the manufacturer's instructions for techniques for dealing with conflicts between boards.

Generally, you can avoid conflicts between PCI and ISA boards by doing the following:

1. Let the PC BIOS assign the IRQ and I/O addresses to the TR114 PCI board.
2. Use the tools supplied with the operating system to determine the interrupts and addresses used by the PCI board.
3. Configure the interrupts and addresses for the TR114 ISA boards.
4. If you are installing a TR114 ISA board in an EISA slot, create an EISA configuration file. Using the BIOS, reserve the interrupt, I/O addresses, and DMA channel (if used). The BIOS will not use the resources that are reserved for ISA (or EISA) boards for your PCI board.

Chapter 3
Connecting to the Telephone Service

This chapter provides information on the following topics:

- T1 and E1 telephone service.
- Connecting the P8V-T1 to T1 service.
- Configuration of the T1 connection.

T1 and E1 Telephone Service

T1 telephone service provides digital data transmission at 1.544 Mbps. One T1 robbed-bit line can carry 24 channels of fax, voice, or other data.

E1 telephone service provides digital data transmission at 2.048 Mbps. One E1 line can carry 30 channels of fax, voice, or other data.

The TR114 board is designed to operate with a T1 or E1 network interface card. T1 network interface cards with robbed-bit signaling and T1/E1 network interface cards with ISDN call control are available from Brooktrout Technology, Inc. In addition, the TR114+P8V-T1 has an integrated T1 (robbed-bit) interface.

Connecting the P8V-T1 to the T1 Telephone Service

The T1 connector, an RJ-45 telephone jack on the TR114+P8V-T1 mounting bracket, provides the connection to the T1 service. See Figure A-1. for the location of the T1 connector.

To connect the TR114+P8V-T1 to T1 service, follow these steps:

1. Insert one end of the T1 cable into the T1 connector in the TR114+P8V-T1's RJ-45 telephone jack.

   The T1 cable that comes with the TR114+P8V-T1 is a twisted cable. If you need a straight or crossover cable, you can order it from Brooktrout Technology or build it yourself (see *Pinouts for the T1 Connector* on page 3-3).

2. Insert the other end of the T1 cable into either the T1 wall jack or the T1 jack on the Channel Service Unit (CSU).

The TR114+P8V-T1 is now connected to T1 telephone service.

Using a Channel Service Unit

The distance between the originating T1 circuit (ask your telephone representative for this information) and its termination point (the T1 connector on the TR114+P8V-T1) determines whether you must connect the T1 connector to a CSU (Channel Service Unit) or directly to a T1 wall jack.

If the T1 circuit is fewer than 500 feet from the TR114+P8V-T1, you do not need to connect the T1 connector to a CSU. If the distance from the TR114+P8V-T1 to the T1 circuit exceeds 500 feet, you must connect the T1 connector to a CSU and the CSU to the T1 wall jack.

CSUs provide these important features:

- Amplify the T1 signal so both ends of the connection detect the signal correctly.
- You may need to configure the CSU to boost or attenuate the signal until both ends can detect the signal correctly.
- Provide constant circuit to the telephone company when a power down occurs.

  Since the T1 line continues to receive signal during a power down (though the T1 line cannot communicate without the PC), providing constant current prevents the telephone company from receiving a T1 line failure alarm.You must provide battery backup to the CSU.
- Provide access to bantam jacks for diagnostic testing and problem solving.

- Provide a loop-back mechanism to the telephone company to test and ensure that signals on the T1 line to the CSU are good.

  Telephone companies use this feature whenever they install a new T1 line or to diagnose line problems.

- Provide other performance monitoring features and LED error warning.

Configuration of the T1 Network Connection

The T1 connection consists of the connector on the TR114+P8V-T1 and the cable supplied by Brooktrout Technology. You may need this information if you need a different kind of cable (see below) or you want to build your own cable.

Pinouts for the T1 Connector

Pins 1, 2, 4, and 5 on the RJ-45 provide T1 data paths to and from the TR114+P8V-T1.

The pins of these connectors are configured as shown in Table 3-1 and as shown in Figure 3-1..

Table 3-1. Pin Configuration of RJ-45 T1 Connector

Tip & Ring	RJ-45 Pin
Transmit Tip	5
Transmit Ring	4
Receive Tip	2
Receive Ring	1

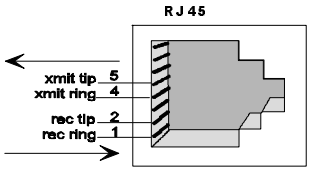

Figure 3-1. Pinouts of the RJ-45

T1 Cables

At some point between the T1 connector on the TR114+P8V-T1 board and the T1 service connector (CSU, wall-mounted jack, PBX), one and only one twist must occur in the wiring to connect the receive tip and ring pins on one connector to the corresponding transmit tip and ring pins on the opposite connector. All other connections must be straight through.

To use the correct cable, you need to know the pinout on the T1 service connector side (CSU, wall jack, or PBX). Brooktrout supplies a 6-foot twisted cable (see *Twisted Cable* below) but in some cases you may need to use a crossover cable (see *Crossover Cable* on page 3-5) or a straight-through cable (see *Straight-Through Cable* on page 3-5) to connect the transmit tip and ring pins on the TR114+P8V-T1 to the receive tip and ring pins on the T1 circuit.

Twisted Cable

The supplied T1 cable (order number: 340-018-02) provides the connection from the board to the T1 network with the proper twist. Figure 3-2 shows the design of the twisted cable.

Figure 3-2. Twisted Cable

Table 3-2 shows the pinouts for the twisted cable.

Table 3-2. Pinouts for the Twisted Cable

RJ-45 Pin on one end of cable	RJ-45 Pin on other end of cable
1	8
2	7
3	6
4	5
5	4
6	3
7	2

Table 3-2. Pinouts for the Twisted Cable

RJ-45 Pin on one end of cable	RJ-45 Pin on other end of cable
8	1

Crossover Cable

If you require a cross-over cable, you can order it from Brooktrout Technology Inc. (order number: 340-144-70). Figure 3-3 shows the design of the crossover cable.

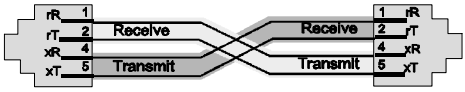

Figure 3-3. Crossover Cable

Table 3-3 shows the pinouts for the crossover cable.

Table 3-3. Pinouts for the Crossover Cable

RJ-45 Pin on one end of cable	RJ-45 Pin on other end of cable
5	2
2	5
4	1
1	4

Straight-Through Cable

If you require a straight cable, you can order one from Brooktrout Technology Inc. (order number: 340-101-07). Figure 3-4 shows the design of the straight-through cable.

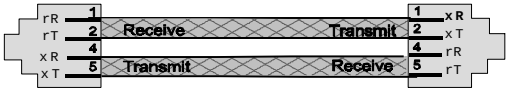

Figure 3-4. Straight-through Cable

Table 3-4 shows the pinouts for the straight-through cable.

Table 3-4. Pinouts for the Straight-through Cable

RJ-45 Pin on one end of cable	RJ-45 Pin on other end of cable
5	5
4	4
2	2
1	1

Chapter 4
Testing and Troubleshooting

Testing the Board

The TR114 PCI board should now be properly configured and installed in your computer. Appropriate telephone service should be installed, and the TR114 board should be connected via MVIP to a TRNIC or TR114+P8V-T1, which is connected to your telephone service.

Note: You cannot use this test on an SCbus board.

Use the TR114 hardware test program, *faxtest.exe*, to test the TR114 by sending and receiving faxes.

Users of LAN fax software may test the board using test software from the LAN fax vendor instead of *faxtest.exe*. See the manual shipped with the LAN fax software for more information.

We recommend that you run *faxtest* on your TR114 board before you replace the cover on your PC and before you configure your fax software for the TR114.

The test software includes:

faxtest.exe	A DOS test program used to send and receive facsimiles.
btdriver.bat, *btk1.exe*, *btk2.exe*	A batch file and DOS program that you must install before you run the *faxtest* program.
user.cfg	A configuration file that contains a number of run-time configuration parameters.
country.cfg	A read-only configuration file with country-specific information.
test-16.pex, *test-164.pex*	Test firmware that the *faxtest* program automatically downloads to the TR114.

send.fil	A single-page Group 3 fax file.
btdriver.cnf	The configuration file that contains the interrupt, DMA channel, and channel addresses of the TR114 ISA fax board or boards that you have installed in your system. The *btdriver* batch file uses this configuration file. If you installed more than one TR114 or installed more than one model of TR series boards, before you run *faxtest*, you must edit and change the configuration file as explained in *Changing the Configuration File* on page 4-3.
digital.cfg	A configuration file used by *faxtest* containing PCM interface configuration information that sets general operation parameters.

To run *faxtest*, you must:

1. Install the test software.
2. Modify the configuration files, if necessary.
3. Boot up your system under DOS.
4. Check and test the configuration settings.
5. Identify the TR114 channels.
6. Test the channels.
7. Shut down DOS and reboot your operating system.

Installing the Test Software

Note: If you are using Windows NT, make sure you do not use the *faxtest* program from a DOS window. Instead, boot from a DOS floppy and run *faxtest* from the floppy drive.

To install the test software in a separate directory (for example *\bfax\faxtest)* on your hard drive, follow these steps:

1. Make the *\bfax\faxtest* directory in which to store the test software. Type:

   `mkdir \bfax\faxtest`

2. Make the new directory the current directory. Type:

   `cd \bfax\faxtest`

3. Copy the files from the diagnostic diskette into the current directory. Type:

   `copy A:*.* *.*`

4. Make sure no other software applications or programs for Brooktrout boards are running.

   For MS-DOS, either edit your current *autoexec.bat* file and remove the lines that run such software, or create an alternate *autoexec.bat* file that does not contain those lines.

5. Reboot your system using the modified or alternate *autoexec.bat* file.

Changing the Configuration File

The configuration file, btdriver.cnf, contains parameters used to identify the interrupt number, dma channel, and base addresses for TR114 ISA boards.

If you install only TR114 PCI boards, you must change the contents of the configuration file to:

```
intnum -1
dmachan -1
```

Since you do not have to specify any addresses for the PCI board, you should delete the line containing the default address (`addrs 264 4`).

If the system has a TR114 ISA board in addition to PCI boards, you must specify the appropriate address, IRQ, and DMA channel for the ISA board, but you should not specify any values for the PCI boards. For example if you install one TR114 ISA 8-channel board in your system (at base address 260) along with your PCI board, change the contents of the configuration file to:

```
intnum 5
dmachan 1
addrs 264 8
```

Testing the Configuration Settings

To test the TR114 board's configuration settings, use the following procedure:

1. Boot up your system to run under DOS.
2. Go to the directory to which you copied the test software. For example, if you copied the test software to the directory *\bfax\faxtest*, type the following:

   ```
   cd \bfax\faxtest
   ```

3. Run the *btdriver* batch file by typing the following command:

   ```
   btdriver btdriver.cnf
   ```

   The batch file should display output on the screen.

4. Check the display output to verify that the program displays the same number of channels that you installed.

   For example, if you have one TR114 8-channel board installed in your system, you should see the following output:

   ```
   Total Channels: 8 TR114; 0 Trufax;
      0 TR112/TR111MC; 0 TR200
   No BRI TR114s found.
   ```

   Note that the *btdriver* batch file checks for *all* TR114 boards, including the TR114 ISDN (BRI) board.

   If you have installed two TR114 8-channel boards in your system, you should see the following output:

   ```
   Total Channels: 16 TR114; 0 Trufax;
      0 TR112/TR111MC; 0 TR200
   No BRI TR114s found.
   ```

5. If the correct number of channels is displayed, skip to *Identifying Channels* on page 4-5.

   If the program fails to find the correct number of channels, run through the following checklist for possible solutions:

   - Make sure the LEDs on the TR114 flash once when you power up your system.

If the LEDs fail to flash or if they remain on, a problem may exist with the TR114 or with the PC. To determine where the problem lies:

1. Install the TR114 in another slot and power up the system again.
2. If the LEDs still fail to operate correctly, install the TR114 in another PC and try again.
3. Check the PC power supply to ensure that it has adequate power for all the devices in the chassis. See *Operating and Environmental Requirements* on page 1-3 for TR114 power requirements.
4. If the LEDs fail to operate correctly after you have tried 1, 2, and 3, contact Brooktrout Technical Support or the reseller from whom you purchased your TR114 board. To contact Brooktrout Technical Support, see *Service Information* on page 5-1.

- If you are installing one or more TR114 ISA boards in addition to a TR114 PCI board, then make sure that:
  - each TR114 ISA board has a unique base I/O address and that it is listed in the *btdriver.cnf* file.
  - the base I/O address switches and the jumper on the interrupt header on the ISA board are set correctly to match the configuration parameter values in the *btdriver.cnf* configuration file.
  - the I/O address settings do not conflict with those of another device in your system.

Identifying Channels

On all TR114 boards, channel numbers start at 0. For example, on 8-channel TR114s, channel numbers are 0, 1, 2, 3, 4, 5, 6, and 7. However, when you run *faxtest* with more than one TR114, *faxtest* does not look for the assigned channel numbers on the boards after the first one. Instead, *faxtest* assumes that channels are numbered sequentially from board to board, starting with the first channel (0) on

the TR114 that occupies the lowest base I/O address and ending with the last channel on the TR114 that occupies the highest base I/O address. For example, if you want to test the second channel on the second TR114 8-channel board, enter `9` as the channel number.

If you are using multiple TR114 PCI boards, it may not be apparent which board corresponds to which addresses and contains which channel numbers. *btdriver* provides two features to assist in identifying boards and channels.

When *btdriver* is run, it prints information about each TR114 PCI board detected including the base address, bus number, device number and function number (the function number is currently always 0). From the base address you can determine which channels are on which board. From the bus and device numbers you can determine the slot in the system in which the board is located. Each slot in the system has a unique bus and device number that correspond to it, so by using one board at a time, the correspondence can be determined for that system.

Also, *btdriver* has a `-f` command line option that allows flashing of LEDs on the board containing a particular channel. After running the *btdriver* initially to assign channel numbers, you can then run it again with the `-f` option to determine which board contains which channel.

Testing Channels

This section provides instructions for testing channels on the TR114. There are two tests: one tests the TR114 by sending a fax, the other tests the TR114 by receiving a fax.

Before You Test Channels

Before testing the TR114, you must perform the following actions:

- Verify that the correct number of channels has been configured, as described in *Testing the Configuration Settings* on page 4-4.
- Connect the TRNIC, the TR114+P8V-T1, or the network interface card to the T1 service.
- Verify that the TR114+P8V-T1 or the network interface card is properly connected to the telephone service.

If connecting to the telephone service via a TR114+P8V-T1, verify that the T1 line is running by checking that the green LED is lit.

If connecting to the telephone service via a different network interface card, verify that the T1 line is running by performing the appropriate test procedure specified by the card's manufacturer.

In addition, you need access to a fax machine to perform these tests.

The faxtest Command

The command used to test channels is *faxtest*. The *faxtest* command has the following syntax:

Send: **`faxtest -u # -s wphonenumber send.fil`**

Receive: **`faxtest -u # -r`**

The parameters and arguments are defined as follows:

`-u`	The unit parameter precedes the number of the channel to be tested.
`#`	Specifies the number of the channel to be tested. Run this test for each channel, typing the appropriate channel number each time. See *Identifying Channels* on page 4-5 for channel mapping information.
`-s`	Places the channel in send mode.
`-r`	Places the channel in receive mode.
`w`	Forces the TR114 to wait for wink (E&M wink protocol) or the availability of a timeslot (E&M immediate protocol). Used with `phonenumber`.
`phonenumber`	The phone number of the receiving fax machine.
`send.fil`	The test file included with the test software.

You should run *faxtest* on each channel in your system to verify that the TR114 boards are operating properly. If you need help on the *faxtest* program, type:

`faxtest`

If you need to stop *faxtest* at any time, press `q` to quit.

Sending a Fax

To test a TR114 channel by sending a fax from it, use the following procedure:

1. Go to the directory to which you copied the test software. For example, if you copied the test software to the directory *\bfax\faxtest*, type the following:

   ```
   cd \bfax\faxtest
   ```

2. Run *faxtest* specifying the channel to be tested, the -s argument and the number of the fax machine to receive the fax. For example, to send the test fax *send.fil* on channel 0 to 781 555-0000, type the following:

   ```
   faxtest -u 0 -s w17815550000 send.fil
   ```

3. If it completes the fax transmission successfully, the *faxtest* program displays the following message:

   ```
   Fax Sent Successfully - Test Completed.
   ```

   Otherwise, it displays an error message. See *Redirecting the Test Results to a File* on page 4-9.

Receiving a Fax

To receive a fax from a fax machine on any channel, follow these steps:

1. If you are not already in the correct directory, go to the directory to which you copied the test software. For example, if you copied the test software to the directory *\bfax\faxtest*, type the following:

   ```
   cd \bfax\faxtest
   ```

2. Run *faxtest* specifying the channel to be tested and the -r argument. For example, to test channel 0, type the following:

   ```
   faxtest -u 0 -r
   ```

3. From a fax machine, dial the telephone number connected to the channel you are testing, and send it a test fax.

4. If the fax is received successfully, the *faxtest* program displays the following message:

   ```
   Fax Received Successfully - Test Completed.
   ```

Otherwise, it displays an error message. See *Redirecting the Test Results to a File* below.

Note: If your T1 is set up as a hunt group for multiple channels, you may have to coordinate with your telephone company to receive a fax from a particular T1 channel.

Redirecting the Test Results to a File

If you still cannot correct the problems you encountered, run the *faxtest* program and redirect the output to a file. Brooktrout Technical Support or the reseller where you bought the TR114 board will want to examine the diagnostic test results to determine the cause of the malfunction.

We recommend that you fax or email the test results to Brooktrout Technical Support or to the reseller. For instructions on how to contact or send test results to Brooktrout Technical Support, see *Chapter 5, Service Information*.

Creating a Message Log

To redirect output to a message log, use one of the command lines shown below. In the examples, # is the number of the channel you are testing, and `log` is the name of the output file. If the program fails to exit on its own, press `q` to quit.

To redirect output from *faxtest* when attempting to send a fax, type:

```
faxtest -u # -v -s wphonenumber >log
```

To redirect output from *faxtest* when attempting to receive a fax, type:

```
faxtest -u # -v -r >log
```

Rebooting the System

To configure your fax software and start sending and receiving faxes with your TR114 board, reboot your system to run under the operating system you normally use.

If your system normally runs under DOS or Windows 95, and you booted your system with a special *autoexec.bat* file to run the test software, reboot your system now using the original *autoexec.bat* file that contains the lines that run your fax application software.

Replacing Your Test Software

If you do not already have *faxtest.exe* or if you need to replace your copy, you can get it from the Brooktrout web site (see *Downloading the Test Software* on page 5-2).

Troubleshooting

You may encounter some of the error conditions listed and described in this section when you run the *btdriver* and *faxtest* programs.

To resolve the error condition, find the description of the problem and follow the instructions given for it. If you still cannot resolve the problem, see *Redirecting the Test Results to a File* on page 4-9.

TR114+P8V-T1 Error Conditions

The TR114+P8V-T1 has two sets of LEDs that can be used to interpret activity on the T1 interface. See *Appendix A, Interpreting LEDs*.

The Loopback Switch

The loopback switch is a toggle switch located on the P8V-T1's mounting bracket. This switch enables and disables network loopback mode. D1, the red LED on the left below the loopback switch on the TR114+P8V-T1, becomes lit when the TR114+P8V-T1 is in network loopback mode. See Figure A-1 on page A-2 for the location of D1 and the loopback switch.

The telephone company uses network loopback mode to test individual channels in the T1 span. Turn network loopback mode on – toggle the loopback switch down – only at the telephone company's request.

Make sure loopback mode is off – toggle the loopback switch up – while the TR114+P8V-T1 is running under normal conditions.

btdriver Conditions

The following messages may be reported by *btdriver*.

Message	Description	Solution
`no fax or voice boards found`	The system cannot find any boards. *Btdriver* should detect eight channels for each eight-channel board.	Put the TR114 in a different slot. Make sure that all the channel LEDs of the board flash once at power up.
`No BRI TR114s Found`	This message is informational. It means that you do not have a TR114 BRI ISDN board in your system.	No action is required.
`Cannot set BFAX_INFO env var. X bytes needed, only found Y. Aborting.`	The driver required more temporary environment space for the `BFAX_INFO` variable than was available.	The environment is limited in space. Different DOS versions use different amounts of default environment space. Change the environment space to a larger setting by putting a `SHELL` directive in your *CONFIG.SYS* file. This directive is used to specify a different command interpreter. The default is *\COMMAND.COM*. To change the environment space setting, insert the following line into *CONFIG.SYS* for DOS versions earlier than 5.0: SHELL=C:\COMMAND.COM /P /E:2048 or for DOS 5.0 and later: SHELL=C:\COMMAND.COM C:\ /P /E:2048 The number 2048 seems to work best in every case. After editing *CONFIG.SYS*, reboot and try again.

faxtest Conditions

The following messages may be reported by *faxtest*.

Message	Description	Solution
`reset failed`	*faxtest* hangs when downloading firmware.	1. Check your *btdriver.cnf* file setting to ensure that the dma and interrupt are both set to -1. 2. Move the board to a different PCI slot. If the reset still fails, contact Brooktrout Technical Support (see *Getting Technical Support* on page 5-1).
`Originate_call: Final Call Progress: Probable human detected`	A human voice was probably detected instead of a fax tone.	Check the telephone number and have the board dial the correct fax number.
`Digital Configuration Error`	The TR114 is not receiving proper clocking signals from the TR114+P8V-T1 or NIC due to a malfunctioning MVIP cable or an incorrect clock setting in the *digital.cfg* file.	1. Replace or check the MVIP cable. 2. Ensure that the MVIP stream selections on the TR114+P8V-T1 or the NIC match the *tstream* and *rstream* numbers in the *digital.cfg* file. 3. Ensure that the *clock_rate* parameter is set to 1 (2.048) in the *digital.cfg* file.
`Reorder Busy`	On outdialing, the TR114 always reports that the line is busy.	1. The system is dialing prematurely. Insert a dialing prefix `ww` or `w,` at the beginning of each dial string. 2. Check your PBX to ensure that calls are routed correctly. You may have to dial 8 or 9 to dial outside.

Message	Description	Solution
`Originate_call: Dial: No dialtone detected`	The board is not detecting a dialtone.	Check the configuration of your T1 line. You can insert a second `w` in the dial string to specify that the TR114 should wait for dial tone. However, if the telephone company does not provide a dial tone, do not put a second `w` in the dial string.
`error 265`	The TR114 is not getting a wink or a timeslot is not available on the T1 line. This error is usually the result of a misconfiguration in the T1 signaling protocol, the T1 network board setup, or the *digital.cfg* file. It is also possible that the T1 trunk and the T1 header board configurations do not match.	1. Check that the signaling protocol your T1 provider is sending matches the settings in the *digital.cfg* file. 2. Check with the phone company that your T1 service is working. 3. Ensure that the green LED on the NIC or TR114+P8V-T1 is on.

Chapter 5
Service Information

In the event of equipment malfunction, Brooktrout Technology, Inc. or an authorized agent should perform all repairs. The user is responsible for reporting the need for service to Brooktrout or to one if its authorized agents.

Getting Technical Support

Brooktrout provides technical support for customers who have purchased their TR114 product directly from Brooktrout Technology, Inc. If you purchased your TR114 board from a reseller, please contact that reseller for technical support.

Before contacting Brooktrout Technical Support, please have the following information at hand:

- The part number (PN) of the TR114 board. The part numbers always begins with the digits “802.” On 900 series boards, the part number is on the back of the TR114 board.
- Test results from running the *faxtest* program. See *Testing Channels* on page 4-6 on how to use the *faxtest* program.

Contact Brooktrout Technical Support by:

- E-Mail:

  US: `techsupport@brooktrout.com`

  Belgium: `eurosupport@brooktrout.com`

  Japan: `inu@dns1.infocom.co.jp`

  Singapore: `singsupport@brooktrout.com`

- Telephone:

U.S.:	781-433-9600 Monday through Friday 8:30AM – 8:30PM Eastern Time
Europe:	+32-2-658-0170
Singapore:	+65-224-4485
Japan:	+81-3-5800-9102

- FTP Site: `ftp://ftp.brooktrout.com`
- Web Site: `http://www.brooktrout.com`

Downloading the Test Software

You can get copies of the latest test software from the Brooktrout web site. To download the software to your PC:

1. Start your Internet browser.
2. Go to the Brooktrout web site by typing:

   `http://www.brooktrout.com`
3. Select *technical support.*
4. Select *downloads.*
5. Select *diag.exe*.

Returning a Defective TR114 Board

If you suspect that your TR114 board is malfunctioning, contact Brooktrout Technology, Inc. or the reseller from whom you purchased the board.

Typically, Brooktrout Technical Support or your reseller will request you to run the diagnostics on the TR114 board in question to determine whether or not it has a hardware defect. If it does, you need to return the board for repair to Brooktrout Technology, Inc. or to the reseller from whom you purchased it.

If you purchased the TR114 board directly from Brooktrout Technology, Inc., Brooktrout will issue a Return Material Authorization (RMA) number for it. When returning a product on RMA to Brooktrout Technology, Inc., you must supply the RMA number clearly on the shipping container and send the container to the following address:

Brooktrout Technology, Inc.
152 Second Avenue
Needham, MA 02494-2722

If your TR114 board is out of warranty, you must get a Purchase Order Number before Brooktrout will issue you an RMA number.

Appendix A
Interpreting LEDs

Channel LEDs

As shown in Figures 2-1, 2-2, and 2-3, channel status LEDs can be viewed through the mounting brackets of the TR114 boards. The LEDs are numbered according to the TR114's channels. Each red LED indicates the activity status of its associated channel. Each LED should

- Flash once at PC power up.
- Flash periodically after firmware is downloaded to the TR114.
- Flash more rapidly when the channel goes off hook.
- Flash when the channel is receiving data from the host computer.

T1 LEDs on the TR114+P8V-T1

In addition to the channel LEDs, the TR114+P8V-T1 has two banks of T1 LEDs that provide information about T1 errors when they occur. The T1 service LEDs project through the mounting bracket as shown in Figure A-1.

The T1 transmission LEDs are located on the top left of the board (see Figure 2-3 for the location). These LEDs indicate T1 errors as described in *T1 Transmission LEDs* on page A-5.

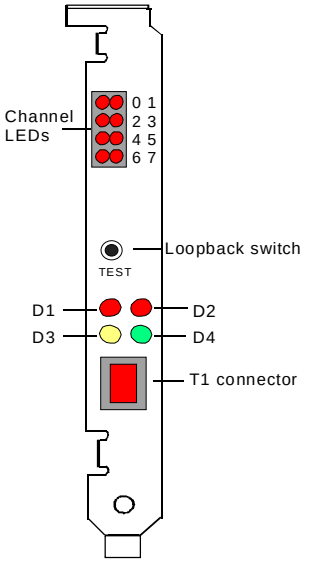

Figure A-1. TR114+P8V-T1 Mounting Bracket with LEDs

T1 Service LEDs

The LEDs labeled D1 through D4 provide information on the T1 service. These LEDs are described in Table A-1.

Table A-1. T1 Service LED Activity

LED	Color	Indicates
D1	Red	TR114+P8V-T1 in network loopback mode.
D2	Red	Loss of T1 network signal.
D3	Yellow	TR114+P8V-T1 failing to synchronize on incoming T1 signal, and sending yellow alarm.
D4	Green	TR114+P8V-T1 receiving error-free T1.

When the TR114+P8V-T1 is operating in normal mode under error-free conditions, only D4, the green LED, is lit. If there are problems, D4 will not be lit. Instead you will encounter one of the following conditions.

Condition	Description	Solution
Yellow LED (D3) and red LED (D2) are lit.	The board cannot detect a valid T1 signal.	1. Ensure that the cable between the network card and T1 is the correct type. For information on the correct type of cable, see *Connecting the P8V-T1 to the T1 Telephone Service* on page 3-1. 2. Ensure that the cable pinouts are correct between the TR114+P8V-T1 and the T1 service connector. See *Pinouts for the T1 Connector* on page 3-3. The tip transmit pin on the T1 should be mapped to the tip receive pin on the P8V-T1 and the ring transmit pin should be mapped to the ring receive pin. 3. Ensure that your T1 service is up and running correctly. 4. Ensure that the P8V-T1 board is not in loop-back mode during testing.
Red LED (D2) is lit	Loss of signal from the T1 network	1. Check the TR114+P8V-T1's cabling and connection to the CSU or T1 wall jack. 2. Check the configuration of the CSU.
Flashing Green LED		Check to see if the clocking parameters match what your T1 provider is set up to provide.

Condition	Description	Solution
Yellow LED (D3) is lit.	The board cannot synchronize on the T1 signal it is receiving	Possible causes are: - Loss of T1 signal. - T1 signal has an invalid framing pattern. - T1 signal contains severe errors. - T1 signal contains Blue Alarm (all 1s) pattern. - AMI/B8ZS, SF/ESF setup parameters of the T1 service do not match what the TR114+P8V-T1 is set up to receive. Check for proper network clock configuration in the T1 signal from the Central Office or from the PBX.
Green LED lit but data is not received or sent to the T1 service.	A clocking conflict between the board and the T1 service, caused by both sides generating and sending T1 clock signals, may prevent the board from synchronizing. When the TR114+P8V-T1 fails to synchronize, it will not receive or send data to the T1 network properly.	1. Check Switch 1 of SW2 for the T1 clock master configuration. Unless the TR114+P8V-T1 is connected to a PBX, configure the TR114+P8V-T1 so that the T1 is the clock master. 2. Check the PBX or Telco to ensure that the T1 line is up and running

T1 Transmission LEDs

The T1 transmission LEDs are located between the MVIP connector and the mounting bracket. See Figure A-2.

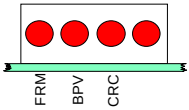

Figure A-2. T1 Transmission LEDs

When lit, these LEDs indicate that T1 transmission errors are occurring and provide additional information about T1 network problems. The T1 transmission LEDs indicate the status of T1 transmission signaling as follows.

LED	Indicates	Solution
FRM	T1 framing error detected. Problems connecting to the T1 circuit are frequently due to incorrect T1 framing.	Cycle switch 2 (frame mode) of SW2 between its SF (UP) and ESF (DOWN) to detect and correct the framing error.
BPV	T1 bipolar violation detected. Bipolar violations are sometimes related to incorrect line coding.	Cycle switch 3 (line coding) of SW2 between B8ZS (UP) and AMI (DOWN) to detect and correct the bipolar violation. If the TR114+P8V-T1 is connected to a CSU, check the configuration of the CSU.
CRC	Discrepancy in cyclic redundancy check detected. Noise on the T1 line or an incorrectly configured cable length can cause repeated discrepancies in the CRC results.	Ensure that there is no noise on the T1 line. Configure the cable to the correct length (see *Setting the T1 Cable Length* on page 2-6).

CSU LEDs

If the TR114+P8V-T1 is attached to a CSU and the CSU's Bipolar Violation or Loss Of Signal lights illuminate, try changing the CSU's Line Build Out setting. The choices are usually 0dB, -7dB, -15 dB, and -22.5 dB.

Appendix B
North American Standards Compliance

Note to developers, system integrators, value added resellers, and distributors: The following compliance information must be provided to your customer and the end user as part of your system documentation.

The Federal Communications Commission (FCC) in the United States and Industry Canada (IC) in Canada regulate all electronic devices that connect to the telephone system and/or generate radio frequency signals. The TR114 is such a device and must comply with the regulations specified below.

Telephony Regulations

FCC Notices for Registered Component Devices

This equipment is registered with the FCC under Part 68 as a component device for use with a host PC. In order for the FCC registration of this product to be retained, all other products used in conjunction with this product must also be FCC Part 68 registered for use with these hosts. If any of these components are not registered, then you are required to obtain FCC Part 68 registration of the assembled equipment prior to connection to the telephone network. Part 68 registration requires that you maintain this approval and as such are responsible for the following:

Any component added to your equipment, whether it bears component registration or not, will require a Part 68 compliance evaluation. You may need to test and make a modification filing to the FCC before that new component can be used.

Any modification/update made by a manufacturer to any registered component within your equipment, will require a Part 68 compliance evaluation. You may need to test and make a modification filing to the FCC before that modified component can be used.

If you continue to produce this component you are required to comply with the FCC's Continuing Compliance requirements.

Therefore, it is recommended that only FCC Part 68 registered devices bearing the 'CN' or 'CE' equipment code as part of the FCC registration number, be used. To determine if your particular components are appropriately approved, look for the FCC registration number on all components and ensure that the equipment code '-CN-' or '-CE-' is part of that number. Refer to the FCC Registration number on this product as an example.

If the telephone company requests that you supply the FCC Registration number and REN of the device you are connecting, please supply the FCC Registration numbers from all component and host devices that have a direct PSTN connection (i.e. have a REN stated on the label) and the highest REN.

If at any time the ownership of this component device is transferred to someone else (whether independently or as part of a system), supply this manual to the new owner.

To ensure that the operation of the TR114 is compliant with FCC and Industry Canada regulations use 0010 as the `country_code` in the user defined configuration file *btcall.cfg*. Use of any other value for the country code or modification of the *BT_CPARM.CFG* file in the *app.src* directory may result in non-compliance of the board and make its connection to the public telephone network illegal.

FCC Rules Regarding Fax Branding

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone fax machine unless such message clearly contains, in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent; an identification of the business, other entity, or individual sending the message; and the telephone number of the sending machine, business, entity, or individual.

Users: To program this information into your fax machine, follow the procedure described in your user manual.

Developers: You must include facilities in your application to enable the user to enter the required information. Use the API's **BfvFaxHeader** function with the TR114 to place this information on each transmitted page as required. You must also include, in your user manual, instructions for entering this information into your system.

FCC Regulations For Connecting to a T1 Phone Line (Part 68)

The Federal Communications Commission (FCC) has established rules that permit the TR114+P8V-T1 to be directly connected to the telephone network:

- Standardized jacks are used for connections.
- This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs. (Contact your state public utility commission or corporation commission for information.)

A malfunctioning circuit can harm the telephone network.

Disconnect a malfunctioning TR114+P8V-T1 board from the telephone network until you determine the cause of the malfunction and repair it. If a malfunctioning TR114+P8V-T1 remains connected, the telephone company may temporarily disconnect service.

The CSU/DSU has been designed to prevent harm to the T1 network. If the telephone company finds that the equipment is exceeding tolerable parameters, the telephone company can temporarily disconnect service, although they will attempt to give you advance notice if possible.

If the telephone company alters their equipment in a manner that will affect use of this device, they must give you advance warning so as to give you the opportunity for uninterrupted service. You will be advised of your right to file a complaint with the FCC.

Under the FCC rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or out of warranty.

Before connecting the TR114+P8V-T1 to telephone service, you must give a representative of the local telephone company the following information:

- The telephone numbers (Port ID) to which the TR114+P8V-T1 is connected.
- SOC: 6.0F
- FIC: 04DU9-BN 1.544Mbps SF

  04DU9-DN 1.544Mbps SF+B8ZS

  04DU9-1KN 1.544Mbps ESF

  04DU9-1SN 1.544Mbps ESF+B8ZS
- The type of wall jack required: USOC-RJ-48C
- The FCC Registration number: Labeled on back of board

IC Equipment Attachment Limitations (CS-03)

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas. Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician, as appropriate.

The Industry Canada certification number is found on the back of the board.

Electromagnetic Emissions

This product was tested for emissions in a personal computer meeting the limits of FCC Part 15, Class B. In order to ensure that it continues to meet the Class A emissions limits it should be installed in a host computer or other enclosure which also meets the Class B limits and bears an FCC Part 15 registration number, a FCC logo and/or a CE marking.

FCC Emissions Information

All computing devices utilizing clock frequencies in excess of 10 kHz must be tested for compliance with RF emission limits set by the FCC.

Changes or modifications to this unit not expressly approved by Brooktrout Technology, Inc. could void the user's authority to operate the equipment.

Pursuant to Part 15 of the FCC Rules, this equipment has been tested and found to comply with the limits for a Class A digital device. These limits provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, it may cause interference harmful to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his or her own expense.

IC Emissions Notice

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la class A est conforme à la norme NMB-003 du Canada.

Safety

The TR114 is recognized by ETL; the component recognition number is on the back of the board. The TR114 has been tested and complies with UL Standard 1950, Third Edition and with CSA Standard C22.2 No.950-95, Third Edition, *Safety of Information Technology Equipment, Including Electrical Business Equipment*.

This product must be mounted in the final assembly so that it is isolated from exposure to any hazardous voltages (voltages greater than 42.4V peak or 60Vdc) within the assembly. Adequate separation and restraint of cables and cords must be provided.

To maintain the safety certification of the system, ensure that the power drawn from the power supply does not exceed its capacity. Please refer to the power usage table elsewhere in this manual for information on the voltages and currents required for proper operation.

Appendix C
Developing Digital Applications

This appendix describes:

- The MVIP and SCbus PCM buses and how the Brooktrout API implements their operations.
- How to modify the *digital.cfg* file to set up the parameters for the MVIP bus.
- How to use DNIS and dialing prefixes on T1 lines.

Developing and testing applications for a T1 environment does not require T1 service. Because applications are not board-dependent, you can develop and test T1 applications in Loop-Start or DID environments initially and switch over to a T1 environment later.

PCM Buses

The TR114 PCI digital boards support the MVIP and SCbus PCM bus protocols. A PCM bus carries digital telephone traffic between boards housed within a PC. This digital traffic is received from and transmitted to a T1 or E1 telephone line via a telephony network interface card. On the TR114+P8V-T1, the T1 interface is built into the board.

The NIC parses command signals (on-hook, off-hook, dial pulses, and so on) from the incoming telephone line to pass to the host. The application must handle all call progress before passing calls to the TR114 boards connected to the bus.

The *digital.cfg* File

The digital configuration file, *digital.cfg*, contains PCM interface configuration information that set general operation parameters. *digital.cfg* is an ASCII file that you can create or edit with a text editor. You can modify the example *digital.cfg* file or create your own.

The first line of the digital configuration file consists of six integers that set general configuration parameters. These parameters must be entered sequentially, in the order shown in the table below. These values apply to all channels on a TR114 board. The values for these parameter settings are:

Parameter	Value
mvip_peb	For MVIP boards, use 1 For SCbus boards: 0 = PEB; 1 = SCSA.
law	0 = A-Law coding (Europe); 1 = μ-Law coding (U.S.).
robbed	0 – Required for MVIP and ignored for SCbus (does not refer to robbed-bit signaling on the T1)
clock_rate	For MVIP boards, use 1 (2.048 MHz). For SCbus boards: SCSA: 1 = 2.048MHz; 2 = 4.096MHz; 3 = 8.192MHz PEB: 0 = 1.544 MHz (U.S.); 1 = 2.048 MHz (Europe).
sig_prot	0 = E&M (AT&T PUB 43801) wink start. 1 = E&M (AT&T PUB 43801) immediate start. 2 = FXS, Loop Start Mode (AT&T PUB 43801) 3 = FXO, Loop Start Mode (AT&T PUB 43801) 4 = Exchange Access North America (FG_D_EANA) 5 = Exchange Access International Signaling (FG_D_EAIN) 6 = Operator Service Signaling (FG_D_OS) 7 = Terminating Protocol (FG_D_TERM) Set this parameter according to your T1 telephone line configuration. Ignored for SCbus.
mf_freq	0 – Required for MVIP and ignored for SCbus.

The remaining lines of the digital configuration file consist of the following parameters:

Parameter	Value
chan	TR114 channel number.
*tstream**	MVIP transmit stream number for the channel; use the even-numbered (data) MVIP stream you selected for the TR114+P8V-T1 or TRNIC.
tslot	T1 transmit time slot number for the channel.
rstream	MVIP receive stream number for the channel; use the even-numbered (data) MVIP stream you selected for the TR114+P8V-T1 or TRNIC.
rslot	T1 receive time slot number for the channel.

* For information about using these parameters for SCbus, see *Assigning Time Slots to Resources* on page C-8.

The example below shows the settings for MVIP boards (for example, two P8V boards and one P8V-T1 board) with 24 channels (a single T1 span) using data stream 6. The line that starts with # is a comment line and does not affect the TR114/NIC operation.

```
# MVIP/PEB A/µ robbed clock_rate sig_prot mf_freq
     1      1    0         1        0        0
#    chan   tstream   tslot   rstream      rslot
      0         6        0        6          0
      1         6        1        6          1
      2         6        2        6          2
      3         6        3        6          3
      4         6        4        6          4
      5         6        5        6          5
      6         6        6        6          6
      7         6        7        6          7
      8         6        8        6          8
      9         6        9        6          9
     10         6       10        6         10
     11         6       11        6         11
     12         6       12        6         12
```

13	6	13	6	13
14	6	14	6	14
15	6	15	6	15
16	6	16	6	16
17	6	17	6	17
18	6	18	6	18
19	6	19	6	19
20	6	20	6	20
21	6	21	6	21
22	6	22	6	22
23	6	23	6	23

MVIP Bus Basics

The MVIP bus is a 40-wire ribbon cable. Sixteen of the MVIP cable's forty serial wires carry data; these physical data lines correspond to logical data units called data *streams* as defined by the MVIP bus protocol.

The TR114 uses the MVIP configuration called *channel-associated signaling*, which is shown in Figure C-1.

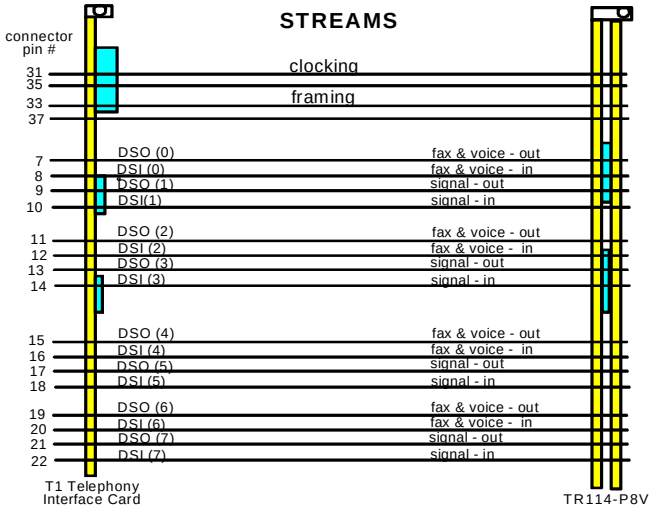

Figure C-1. Channel-Associated Signaling Stream Configuration

In this configuration, the sixteen streams are grouped into four sets of four streams each. Each set contains two input and output pairs; each pair consists of one data and one signaling stream, enabling the bus to carry 128 separate voice, fax, data, or mixed channels.

The *frame* is the basic unit of a logical MVIP data stream (see Figure C-2). A frame consists of thirty-two 8-bit time slots. A time slot corresponds to one telephone call.

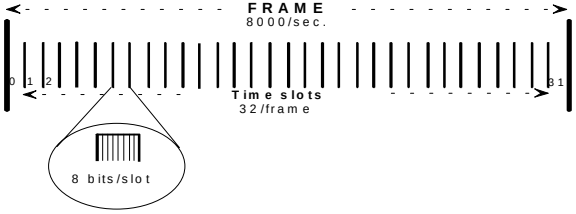

Figure C-2. Basic Unit of a Logical MVIP Data Stream

Eight thousand frames are transmitted every second on a data stream. This rate translates into a time slot transmission rate of 64,000 bps. Thus, a stream carrying thirty-two time slots transmits at a rate of 2.048 Mbps.

How the API Implements MVIP Operation

At system startup, the Application Programming Interface (API) loads each TR114 with parameters that designate which of the four sets of streams will be used for data and which will be used for signaling. The choices are streams 0/1, 2/3, 4/5, or 6/7. The first stream in each pair transmits data, and the second stream in each pair transmits signals.

During operation, the API selects a time slot from one of the streams and associates it with one of the TR114's channels (for example, eight slots must be selected and associated with an 8-channel board's eight channels). Once time slots are associated, the TR114 monitors each slot for incoming calls and transmits over each slot on outgoing calls. Only calls on API-selected slots are monitored, so calls arriving on or switched to unassociated slots are not answered.

Because each TR114 can use up to 32 time slots in one of the sixteen data streams, up to 32 channels on any combination of 2-, 4-, 8-, 12-, and 16-channel boards can be configured for operation on each stream.

All TR114 channels on the same board must use the same data stream and each slot in any stream can associate with only one TR114 channel in a system. Therefore, make sure no two TR114 channels, either on the same board or on different boards, are associated (via the API) with the same slot in the same stream; that is, slot x on stream A must be associated with only one TR114 channel. If any changes in slot-to-channel assignment are made during operation, these changes must be coordinated with all devices that use the affected slots or with any switching or network devices. Unique slot-to-channel association must be ensured and maintained.

We recommend making a one-time slot assignment via the *digital.cfg* file if you are using Brooktrout TRNIC boards. If you are using another manufacturer's telephony network interface card, we recommend using dynamic reassignment of slot-to-channel associations via the API.

SCbus Basics

The SCbus protocol logically divides the cable's twenty-six serial wires into the *Data Bus*, which carries data, and the *Message Channel*[1], which carries messages between boards or between board components. All physical wires on the Data Bus and the Message Channel correspond to logical units called *streams*.

The Data Bus carries data on sixteen bi-directional streams. The Data Bus can transfer data at 2.048 Mbps, 4.096 Mbps, or 8.192 Mbps. However, the nominal speed of ribbon cable implementations is 4.096 Mbps. Only backplanes that achieve correct signal termination can run at 8.192 Mbps. Depending on the data transfer rate used, the SCbus can carry 512, 1024, or 2048 separate voice, fax, data, or mixed channels.

1. The TR114 board does not support this feature.

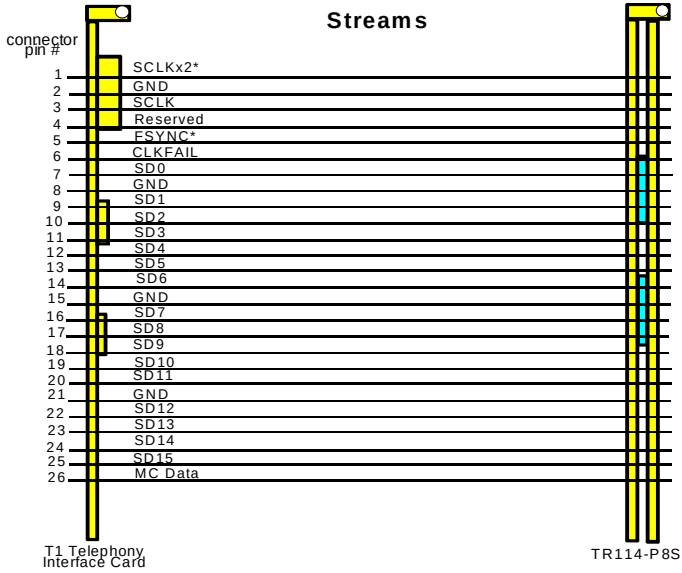

Figure C-3. SCbus Distributed Signaling Configuration

The *frame* is the basic unit of a logical SCbus data stream. A frame consists of 32, 64, or 128 8-bit time slots. A time slot corresponds to one telephone call.

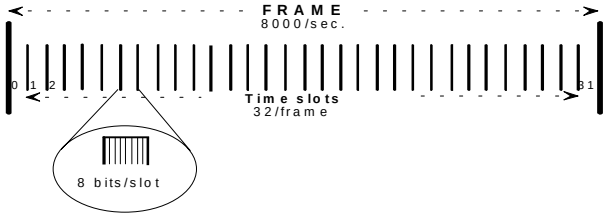

Figure C-4. Basic Unit of a Logical SCbus Data Stream Operating at 2.048 Mbps

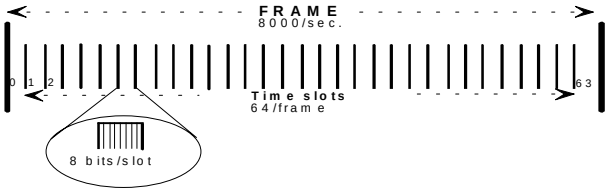

Figure C-5. Basic Unit of a Logical SCbus Data Stream Operating at 4.096 Mbps

Eight thousand frames are transmitted every second down a data stream. This rate translates into a time slot transmission rate of 64,000 bps. Thus, a stream carrying 32 time slots transmits at a rate of 2.048 Mbps, and a stream carrying 64 time slots transmits at a rate of 4.096 Mbps.

Implementing SCbus Operation

The TR114 is designed to use the distributed switching architecture (SCSA) of the SCbus (see Figure C-3) or to emulate PEB operation. The Brooktrout API provides parameters in the *digital.cfg* file to support each mode (see *The digital.cfg File* on page C-2 and Appendix C, Volume 2 of the *Fax and Voice Application Programming Interface)*.

The SCbus data path provides a point-to-point link between two ports, enabling:

- Association of any T1 time slot to any SCbus time slot.
- Ports to use any SCbus time slot to transmit or receive data.
- Only one port at a time to transmit data on a particular time slot.
- Any number of ports to receive data from the same time slot.
- Any port to reroute an incoming call on a T1 time slot to an outbound call on another T1 time slot.

Assigning Time Slots to Resources

All resources on the SCbus have a transmit time slot and a receive time slot. A full duplex connection is created between two resources when the transmit time slot of each resource links to the other's receive time slot.

At initialization, the switch handler, software on the NIC, selects the time slots the NIC will use to transmit data over the SCbus, and these time slots remain assigned to the NIC until the system is powered off. Only the NIC can transmit data over these selected time slots.

You assign the time slots the TR114 channels will use to transmit data (`tslot`) and the time slots it will use to receive data (`rslot`) in the *digital.cfg* file.

Since the NIC takes its transmit time slots at initialization, it determines which time slots other resources can use to transmit data. So, to avoid conflicts, before you assign transmit and receive time slots to the TR114, query your NIC (see the vendor's documentation for instructions) for the transmit time slots it is using.

On the SCbus, the relationship between streams and time slots depends on the clock rate used:

Table C-1. SCbus Stream and Timeslot Associations

SCbus Stream	2.048 MHz Time Slots	4.096 MHz Time Slots
0	0 – 31	0 – 63
1	32 – 63	64 – 127
2	64 – 95	128 – 191
3	96 –127	192 –255
4	128 – 159	256 – 319
5	160 – 191	320 – 383
6	192 – 223	384 – 447
7	224 – 255	448 – 511
8	256 – 287	512 – 575
9	288 – 319	576 – 639
10	320 – 351	640 – 703
11	352 – 383	704 – 767
12	384 – 415	768 – 831
13	416 – 447	832 – 895
14	448 – 479	896 – 959
15	480 – 511	960 – 1023

The `tslot` and `rslot` fields in the *digital.cfg* file are limited to two digits, preventing use of the SCbus time slots 100 through 1023. To work around this limitation, the API uses stream/time slot pairs. In this scheme, time slot numbers in each stream begin at 0 and end at 31 or 63, depending on the clock rate used. Using stream 8 as an example, Table C-2 shows how API time slots correspond to SCbus time slots.

Table C-2. API Time Slot Numbering

	SCbus Time slots	API Time slots
Stream 8 **4.096 MHz** **64 time slots/stream**	512	0
	513	1
	514	2
	515	3
	516	4
	517	5
	518	6
	519	7
	520	8
	521	9
	522	10
	…	…
	575	63

For example, to assign TR114 channel 2 to transmit on SCbus time slot 515 and to receive on time slot 521, enter the following information in your *digital.cfg* file:

#	*chan*	*tstream*	*tslot*	*rstream*	*rslot*
	2	8	3	8	9

Setting Up to Operate in PEB Mode

To operate in PEB mode, you must:

- Connect a PEB cable to the TR114's SCbus connector.
- Specify PEB operation parameters in the *digital.cfg* file.
- Assign each TR114 channel an SCbus transmit and a receive time slot via the *digital.cfg* file.

In *digital.cfg*, you must set the following three parameters:

- mvip_peb: 0
- law: 0 = A-Law decoding; 1 = μ-Law decoding
- clock_rate: 0 = 1.544, 1 = 2.048

The other parameters are ignored.

Although you can assign transmit and receive time slots independently of each other, you must always assign stream 0 to transmit (`tstream`) and stream 1 to receive (`rstream`). The Brooktrout API automatically makes these stream assignments when `mvip_peb` is 0.

Thus, depending on the clock rate used, in PEB mode the TR114 can use SCbus time slots 0 through 23 (1.544 MHz) or 0 through 31 (2.048 MHz) only.

So, to define and assign TR114 channel 2 SCbus time slot 14 to transmit on and time slot 24 to receive on, you would enter this information in your *digital.cfg* file:

#	*chan*	*tstream*	*tslot*	*rstream*	*rslot*
	2	0	14	1	24

If you enter a value other than 0 in `tstream` and 1 in `rstream`, the Brooktrout API ignores it and uses the correct values when the value of `mvip_peb` is 0.

Setting Up to Operate in SCSA Mode

To operate in SCSA mode, you must:

- Connect an SCbus cable to the TR114's SCbus connector.
- Specify SCSA operation parameters in the *digital.cfg* file.
- Assign each TR114 channel an SCbus transmit and a receive time slot via the *digital.cfg* file.

In *digital.cfg*, you must set the following three parameters:

- mvip_peb: 1 (SCSA)
- law: 0 = A-Law decoding; 1 = μ-Law decoding
- clock_rate: 1 = 2.048, 2 = 4.096, 3 = 8.192

The other parameters are ignored.

To define and assign TR114 channels' SCbus transmit and receive time slots, you enter transmit and receive stream/time slot pairs as described in *Assigning Time Slots to Resources*.

How the API Implements SCSA and PEB Modes

During channel reset, the API loads each TR114 with operation parameters; one of these parameters designates the clock rate to use. Depending on the mode specified, the choices are 1.544 MHz, 2.048 MHz, 4.096 MHz, or 8.192MHz. According to the clock rate specified, each of the SCbus' sixteen data streams carries 24, 32, 64, or 128 time slots to interface with those of the T1 or E1 network. For each stream, SCbus time slots are numbered from 0 to 23, from 0 to 31, from 0 to 63, or from 0 to 127.

During operation, the API selects a transmit time slot and a receive time slot from one or more streams and associates it with one of the TR114's channels (sixteen slots for an 8-channel board, eight slots for a 4-channel board, and four slots for a 2-channel board). Once time slots are associated, the TR114 monitors each receive slot for incoming calls and transmits over the transmit slots for outgoing calls. Only calls on API-selected slots are monitored, so calls arriving on or switched to unassociated slots are ignored.

The application can change time-slot-to-channel assignments during operation, but it must coordinate these changes with other resources that use the affected time slots. Full duplex paths require transmit time-slot-to-receive time slot connections between the NIC and resource. And, while only one resource at a time can transmit on the same time slot, no resource can transmit on any of the NIC's transmit time slots.

Each time the system reboots, you must query the NIC for its time slot assignments before you run your application, whether you use the previous time slot-to-channel assignments or new ones.

Using DNIS on T1 Lines

Dialed Number Identification Service (DNIS) is a common option on T1 lines that use DTMF to transmit digits. Like Direct Inward Dial (DID) on analog telephone lines, on incoming calls, DNIS transmits the last few digits of the dialed number to the receiver, providing information useful for routing faxes in LAN-FAX applications.

When you purchase your T1 service with DNIS, you specify how many DNIS digits you want the telephone company to transmit. Then you must configure the TR114 for the same number of DNIS digits through software.

- For third party applications, see the documentation that came with it for instructions on how to configure the TR114 for DNIS digits. Brooktrout maintains a list of digital TR114 configuration settings for specific LAN-FAX applications. To obtain this list, call the Brooktrout Technical Support Fax-On-Demand system at 781-449-9010.
- For API applications, you configure the DNIS digits with the `did_digits` keyword in the *btcall.cfg* configuration file. (See the example *btcall.cfg* configuration file in the sample application directory *bfax\app.src*.) You can change this parameter at any time without executing a hardware or simulated hardware reset.
- For the DOS test program, *faxtest*, configure the DNIS digits with the `did_digits` keyword in the *user.cfg* configuration file.

Using Dialing Prefixes to Dial Out

Another T1 option provides dial tone to a channel when the channel goes off-hook. Because of dialing prefixes, it is useful to know if your T1 service includes this option.

For all applications, note that a dialing prefix inserted at the beginning of the dial string controls how the TR114 dials out.

Prefix	Action
`w`	1. If `w` is the first digit in the dial string, checks the availability of the time slot or wink. 2. If `w` is other than the first digit in the dial string, waits for the dial tone before dialing the first digit in the dial string
`,`	Delays one second before dialing the first digit in the dial string.

If your T1 service provides dial tone, we recommend that you insert `ww` before the first digit in your dial string so that the TR114 will check the availability of the time slot and then wait for the dial tone. If your service does not provide dial tone or if you are not sure, we recommend that you insert `w,` before the first digit in your dial string so the TR114 will check for the availability of the time slot and then delay one second.

For third party applications, see the documentation that came with it for information about the dialing prefixes it uses.

Appendix D
Using Two or More NICs on the MVIP Bus

In rare cases, you may have to put two or more NICs on a single MVIP bus. Be aware that each resource board (such as TR114 boards) connected to that MVIP must be configured to transfer data on all channels through only one NIC.

This appendix describes some of the issues involved and how to configure the TR114+I8V-T1 so that it functions properly.

Setting MVIP Clock Master (MASTR)

The MASTR switch (switch 3 of SW3) controls whether the TR114+I8V-T1 being configured is the MVIP clock master. The clock master generates clocking signals to the MVIP bus. Only one NIC can be set to be the clock master.

MASTR	Result
UP	The TR114+I8V-T1 will generate the clocking signals to the MVIP bus.
DOWN	The TR114+I8V-T1 will not generate the clocking signals to the MVIP bus.

Setting MVIP Clock Synchronization

Switch 4 (SEC8K) of SW3 is called the clock synchronization switch. It can have one of two functions depending on the setting of the MVIP clock master switch.

If the TR114+I8V-T1 being configured is designated as MVIP clock master, *it* will be the NIC that synchronizes the MVIP clocks using a T1 framing signal. It can use its own (clock sync UP) or another NIC's (clock sync DOWN) T1 framing signal.

If the TR114+I8V-T1 is not the MVIP clock master, its T1 framing signal (the Sec. 8K signal) is output (clock sync DOWN) or is not output (clock sync UP) to the MVIP bus, which may or may not use it to synchronize the MVIP clocks. These switch states are shown in Table D-1.

Table D-1. MVIP Clock Synchronization

MVIP clock master switch	Clock sync switch	Result
UP	**UP**	Sets the TR114+I8V-T1 to use its own T1 framing signal to synchronize the MVIP clocks.
	DOWN	Sets the TR114+I8V-T1 to use the T1 framing signal from another network interface card to synchronize the MVIP clocks.
DOWN	**UP**	Prevents the TR114+I8V-T1 from outputting its T1 framing signal to the MVIP bus.
	DOWN	Sets the TR114+I8V-T1 to output its T1 framing signal to the MVIP bus.

Setting Stream Selection

If you have more than one T1 line transmitting to more than one NIC on a single MVIP, you may have to set different data/signal streams for the different T1 lines. You set the streams using switches 1 and 2 of SW3. Once you have selected the streams on the TR114+I8V-T1, you must edit the *digital.cfg* file for the TR114 boards (or its equivalent for other resource boards) to ensure that the data/signal streams for the TR114s match the streams for the TR114+I8V-T1 through which the TR114 transfers data.

MVIP Clock Termination

Even if you have more than one NIC on the MVIP bus, the clock termination requirements are basically the same as when you have a single NIC on the bus. MVIP clock termination requirements depend on the number of connections on the MVIP bus. Follow these guidelines:

- Install the NIC designated as clock master at one end of the cable.
- For systems with 5 or fewer MVIP bus connections, terminate the resource board (such as a TR114) at the end of the cable opposite the NIC. Make all other boards on the cable unterminated including the clock master NIC and any other NICs.
- For systems with more than 5 MVIP bus connections, terminate both ends of the MVIP cable – the clock master NIC *and* the resource board at the opposite end of the cable. Make all other boards on the cable, including any other NICs, unterminated.

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